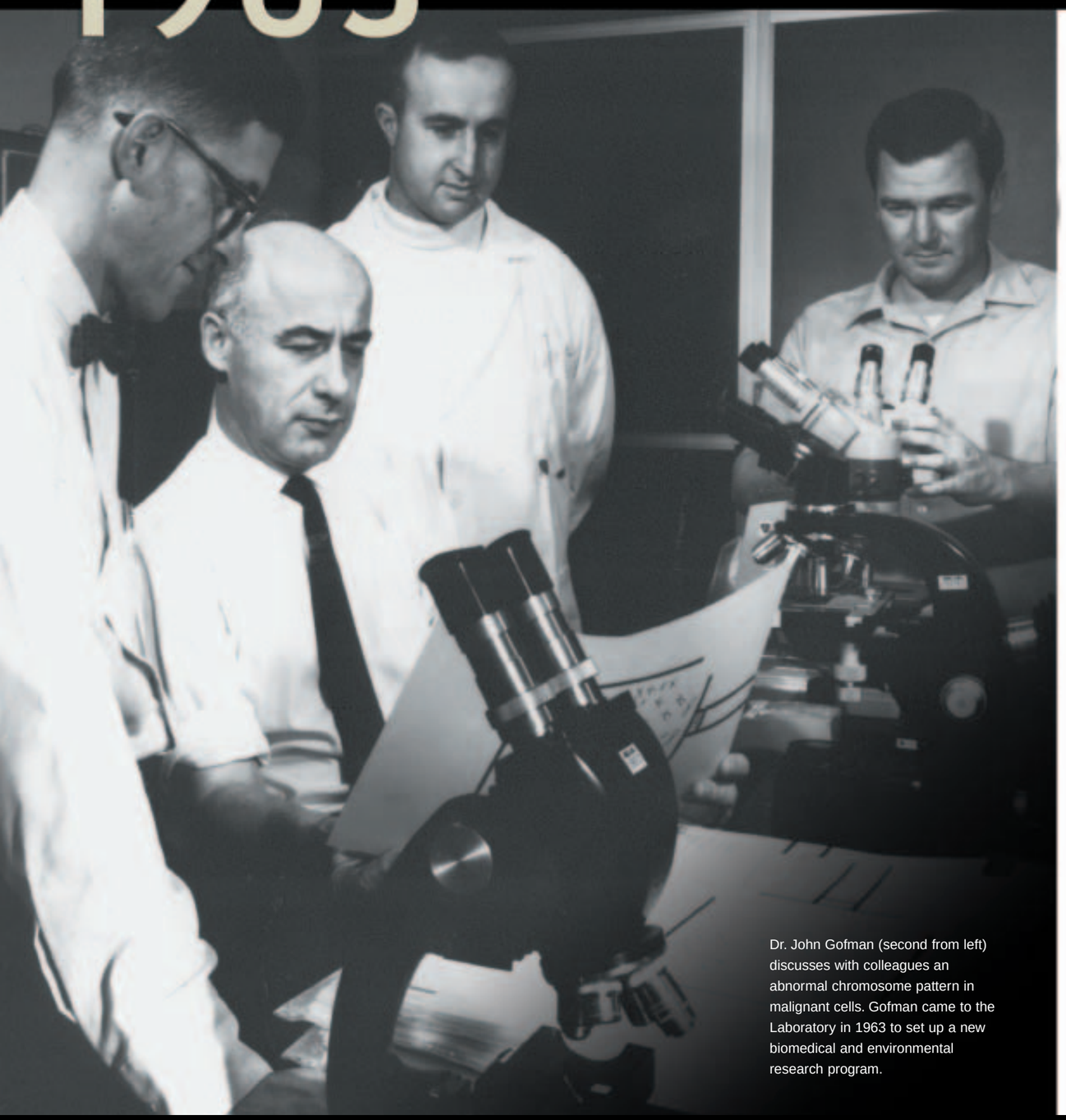


Dr. John Gofman (second from left) discusses with colleagues an abnormal chromosome pattern in malignant cells. Gofman came to the Laboratory in 1963 to set up a new biomedical and environmental research program.

To Understand the Effects of Radiation

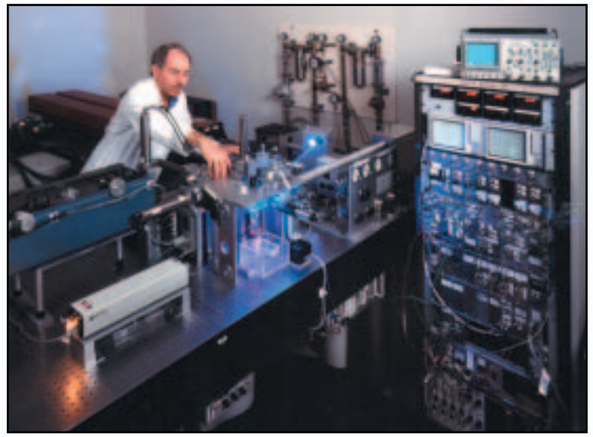
The first biomedical and environmental research program began at Livermore in 1963. The Atomic Energy Commission had been conducting research into the biological consequences of fallout radiation since 1954. As the need grew for a bioenvironmental presence at the Nevada and Pacific test sites, the decision was made for this work to take place at Livermore. John Gofman, a distinguished professor at the University of California at Berkeley who was recruited to set up the program, was given the biomedical charge of studying the effects of radiation on humans.

In the early 1970s, the biomedical focus of the program shifted toward biological measurements that indicated the dose to subjects who had been exposed to radiation. That work led to an examination of the effects of radiation and other toxins on the building blocks of the human genetic apparatus. Increasingly, the focus was on DNA—how it is damaged, what damages it, how it repairs itself, and how these processes may vary with the genetic makeup of the individual. Technology development at Livermore and Los Alamos provided the basis for the Department of Energy's decision to launch its Human Genome Initiative in 1987 (see Year 1987). That initiative evolved into the international Human Genome Project, which took on the task of sequencing all of the 3 billion base pairs of our DNA. A major player, Livermore was one of the dozen or so laboratories in the world participating in the largest biological research project ever undertaken.

Biomedical scientists worked with engineers, physicists, laser experts, chemists, and materials scientists to develop Livermore's preeminence in flow cytometry, a technique for measuring and separating cells. Other innovations in analyzing and purifying biological samples, imaging chromosomes and DNA, early sequencing procedures, and associated database processes were a direct result of in-house, multidisciplinary expertise. The Laboratory's strength in computations has led to unique capabilities in computer simulation of biological processes, such as predicting the three-dimensional structure of proteins directly from DNA sequence data.

This same cooperative spirit has led Livermore's Center for Accelerator Mass Spectrometry (CAMS) to concentrate on biological measurements (see Year 1990). The extraordinary sensitivity of AMS means that it can detect, for the first time, the interaction of mutagens with DNA in the first step in carcinogenesis.

As Livermore moves into its second 50 years, the concern about terrorism has Laboratory scientists working together to improve detection systems for biological and chemical agents (see Year 2001). The Winter Olympics of 2002 was the first staging ground for Livermore methods to continuously monitor crowd venues for the presence of such agents. Given the growing concerns about bioterrorism, the Olympics was the first of many applications of our bioscience research to homeland defense.



Early groundbreaking work in flow cytometry, a technique for separating specific cells from other cells, has led to numerous medical research applications in genomics research and national security applications, such as biosensors that detect specific agents used in biological weapons.